Controversies in Bronchoscopy

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Outline

- Aspirin/Clopidogrel
- Acute myocardial infarction (AMI)
- Arrhythmia
- Elevated intracranial pressure
- Pulmonary hypertension
- COPD
- Asthma
- Pregnancy
- Obesity
- Mechanical ventilation/ARDS
Disclosures

- Scientific Advisor, Olympus Medical Systems, Tokyo, Japan
- Scientific Advisor, Olympus Respiratory America, Redmond, WA, USA
- Scientific Advisor, Broncus Technologies, Mountain View, CA, USA
Transbronchial Lung Biopsy – Aspirin

<table>
<thead>
<tr>
<th>Bleeding</th>
<th>Aspirin Group (n = 285), No. (%)</th>
<th>Control Group (n = 932), No. (%)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>5 (1.8)</td>
<td>27 (2.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Moderate</td>
<td>3 (1.1)</td>
<td>13 (1.4)</td>
<td>NS</td>
</tr>
<tr>
<td>Severe</td>
<td>2 (0.9)</td>
<td>7 (0.8)</td>
<td>NS</td>
</tr>
<tr>
<td>Total</td>
<td>10 (3.5)</td>
<td>47 (5)</td>
<td>NS</td>
</tr>
</tbody>
</table>

*See Table 2 for abbreviations not used in the text.

Herth FJ. Chest 2002; 122: 1461-1464
Transbronchial Lung Biopsy – Clopidogrel

- Clopidogrel
  - 604 patients
  - Stopped early

Table 2—Severity of Bleeding in 48 Patients After Transbronchial Biopsy by Antiplatelet Use*

<table>
<thead>
<tr>
<th>Degree of Bleeding</th>
<th>Clopidogrel Group (n = 18)</th>
<th>Clopidogrel and Aspirin (n = 12)</th>
<th>Control Group (n = 574)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>5 (27)</td>
<td>0</td>
<td>9 (1.5)</td>
<td>&gt; 0.001</td>
</tr>
<tr>
<td>Moderate</td>
<td>6 (34)</td>
<td>6 (50)</td>
<td>9 (1.5)</td>
<td>&gt; 0.001</td>
</tr>
<tr>
<td>Severe</td>
<td>5 (27)</td>
<td>6 (50)</td>
<td>2 (0.3)</td>
<td>&gt; 0.001</td>
</tr>
<tr>
<td>Total</td>
<td>16 (88)</td>
<td>12 (100)</td>
<td>20 (3.4)</td>
<td>&gt; 0.001</td>
</tr>
</tbody>
</table>

*Data are presented as No. (%).
Safety of Endobronchial Ultrasound-Guided Transbronchial Needle Aspiration for Patients Taking Clopidogrel: A Report of 12 Consecutive Cases

David R. Stather, Paul MacEachern, Alex Chee, Alain Tremblay
Division of Respiratory Medicine, University of Calgary, Calgary, Alta., Canada

Respiration (DOI: 10.1159/000335254)

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>ASA</th>
<th>Clopidogrel indication</th>
<th>EBUS-TBNA indication</th>
<th>Samples/results</th>
<th>Diagnosis</th>
<th>Follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>78</td>
<td>M</td>
<td>yes</td>
<td>CAD/stent</td>
<td>lung cancer staging and diagnosis</td>
<td>4R,7 = normal LN, left lower-lobe mass = adenocarcinoma</td>
<td>adenocarcinoma of the lung</td>
<td>2.5 years</td>
</tr>
<tr>
<td>2</td>
<td>71</td>
<td>M</td>
<td>yes</td>
<td>CAD/stent</td>
<td>persistent mediastinal adenopathy after pneumonia</td>
<td>11R = normal LN, 7 = anthracitic LN</td>
<td>reactive adenopathy (resolved on repeat imaging)</td>
<td>6 months</td>
</tr>
<tr>
<td>3</td>
<td>81</td>
<td>F</td>
<td>no</td>
<td>CVA</td>
<td>mediastinal adenopathy</td>
<td>7 = NCG, 4R,11R = normal LN</td>
<td>sarcoidosis</td>
<td>12 months</td>
</tr>
<tr>
<td>4</td>
<td>78</td>
<td>F</td>
<td>yes</td>
<td>CAD/stent</td>
<td>mediastinal adenopathy/interstitial lung disease</td>
<td>7,4L,4R = normal LN, BAL = 30% eosinophils repeat bronchoscopy, off clopidogrel, revealed CEP in transbronchial biopsy</td>
<td>chronic eosinophilic pneumonia</td>
<td>4 years</td>
</tr>
<tr>
<td>5</td>
<td>74</td>
<td>M</td>
<td>no</td>
<td>CAD/CVA</td>
<td>right lower-lobe mass and mediastinal adenopathy</td>
<td>11R,7 = adenocarcinoma</td>
<td>adenocarcinoma of the lung</td>
<td>3 months</td>
</tr>
<tr>
<td>6</td>
<td>72</td>
<td>F</td>
<td>yes</td>
<td>CAD/stent</td>
<td>lung masses and mediastinal adenopathy</td>
<td>12R,7,11L = adenocarcinoma</td>
<td>adenocarcinoma of the lung</td>
<td>2 months</td>
</tr>
<tr>
<td>7</td>
<td>71</td>
<td>M</td>
<td>yes</td>
<td>CAD/stent</td>
<td>right upper-lobe mass and mediastinal adenopathy</td>
<td>4R = adenocarcinoma</td>
<td>adenocarcinoma of the lung</td>
<td>3 months</td>
</tr>
<tr>
<td>8</td>
<td>61</td>
<td>F</td>
<td>no</td>
<td>CVA</td>
<td>bronchiectasis and large 11R</td>
<td>11R = normal LN</td>
<td>mycobacterium avium complex</td>
<td>3 years</td>
</tr>
<tr>
<td>9</td>
<td>67</td>
<td>F</td>
<td>yes</td>
<td>CAD/stent</td>
<td>prior non-small-cell lung cancer (resected) now with large 4R</td>
<td>4R = squamous cell carcinoma</td>
<td>squamous cell carcinoma of the lung</td>
<td>3 months</td>
</tr>
<tr>
<td>10</td>
<td>81</td>
<td>F</td>
<td>no</td>
<td>CVA</td>
<td>smoker with mediastinal adenopathy and lung mass</td>
<td>7, left lower-lobe mass = small-cell carcinoma</td>
<td>small-cell lung cancer</td>
<td>1 month</td>
</tr>
<tr>
<td>11</td>
<td>85</td>
<td>M</td>
<td>yes</td>
<td>CVA/CAD</td>
<td>smoker with UIP and borderline adenopathy and left upper-lobe nodule</td>
<td>11R,4R,11L = normal LN</td>
<td>staging bronchoscopy = stage IA non-small-cell lung cancer</td>
<td>3 months</td>
</tr>
<tr>
<td>12</td>
<td>73</td>
<td>M</td>
<td>yes</td>
<td>CVA/CAD</td>
<td>smoker with right hilar mass</td>
<td>11R,12R = small-cell lung cancer</td>
<td>limited small-cell lung cancer</td>
<td>5 months</td>
</tr>
</tbody>
</table>

In all cases, no significant bleeding was seen at bronchoscopy, no procedure-related complications occurred and clopidogrel dose = 75 mg once daily orally.

ASA = Aspirin; CAD = coronary artery disease; CEP = chronic eosinophilic pneumonia; CVA = cerebrovascular disease; LN = lymph node; NCG = noncaseating granuloma; UIP = usual interstitial pneumonitis.
Transbronchial Lung Biopsy – Fluoroscopy?

- Helps to localize a focal lesion for biopsy
- Hypothetical: Reduction in iatrogenic pneumothorax?
- Post-biopsy evaluation of pneumothorax
- May assist in directing bronchoscope if bleeding
- Obviate post-CXR: No routine recommendation for CXR.

- 1989 ACCP survey 75% pulmonologists use for biopsy
  - 12.1% admitted for observation post-TBBx
- 1999 AAB survey 66%
- ATS does not recommend fluoroscopy for all TBLB
- BTS recommends for localized lesions/infiltrates only
- Cost of machine, radiation safety monitoring, dosimetry, lead…

Prakash UBS. Chest 1991; 100: 1668-1675
Colt HG. J Bronchol 2000; 7: 8-25
Simpson FG. Thorax 1986; 41: 311-317
Honeybourne D. Thorax 2001; 56: 1-21
Recent myocardial infarction

- Retrospective review of CCU patients undergoing FB
- 40 (0.5%) patients out of 8,330 had FB and 21 (53%) had AMI
- No ischemic events were recorded due to FB
  [Chest 1998;114:1660-1667]

- 20 patients underwent FB
- mean of 11.7 days from AMI
- 10 of these had been revascularized prior to FB
- none had documented ischemia during FB.
- Concluded safe to do FB if no signs of active ischemia
  [Dweik R et al, Chest 1996, 110:825-828]
Bronchoscopy in MI

Conclusions

- Bronchoscopy is safe in the immediate post-AMI period as long as patient does not have active ischemia at time of procedure
- Minimize hypoxemia by oxygen supplementation and cough by minimal endobronchial suctioning
- Adequate sedation and analgesia decreases incidences of tachycardia and hypertension and minimizes cardiac oxygen demand
- Continuous pulse oximetry and EKG monitoring

- Extreme caution with CHF and poor LVEF

- Bronchoscopy should be avoided if possible within 4-6 weeks of myocardial infarction

Dweik R. Analysis of the safety of bronchoscopy after recent AMI. Chest 1996;110;825-8
Arrhythmia

- General consensus: bronchoscopy is contraindicated in ongoing and untreated life-threatening arrhythmias
  - Unstable cardiac arrhythmia causing hemodynamic instability
  - Malignant ventricular arrhythmia
    - Ventricular fibrillation, recurrent sustained V-tach, torsades de pointes in long QT syndrome
- No clear guidelines on bronchoscopy risks for specific rhythms
- Most authors recommend continuous EKG monitoring including post-procedure
In fact, results show...

- The effect of fiberoptic bronchoscopy on cardiac rhythm
  - N=70 patients prior to, during, and following fiberoptic bronchoscopic procedures.
  - Major cardiac arrhythmias occurred in 11% (8/70) of the patients during the bronchoscopic procedure.
  - All arrhythmias were self-limited and had no hemodynamic consequence.
  - Patients with evidence of CAD, COPD, or previously known PVCs were at no higher risk for developing major arrhythmias.
  - Hypoxemia (PaO2< 60 mm Hg) at the end of the procedure correlated significantly with the development of new major arrhythmias.

Elevated Intracranial Pressures

- Bronchoscopy shown to cause elevation of ICP in some patients with head injuries
  - However, MAP also rises and thus CPP is maintained
  - No clinically significant increase in ICP or change in GCS score or neurologic findings post-bronchoscopy

- Literature review shows bronchoscopy carries low risk in patients with elevated ICP
Another important factor for bronch in elevated ICP

*Lidocaine toxicity*

- Can lower the seizure threshold
- Maintain within 5-8 mg/kg dose

BTS Guidelines on Diagnostic Flexible Bronchoscopy
Thorax 2001; 56( S1-21 )
Pulmonary Hypertension

- Lack of studies evaluating safety of bronchoscopy in PH
- Survey in 2001 at ACCP conference re: TBLB
  - 29% feel PH is absolute contraindication
  - 58% feel PH is relative contraindication
  - 13% do not feel PH is contraindication
  - 40% feel MPAP >40 is contraindication
- Bronchoscopists have different thresholds
- General practice: considered relative contraindication for TBLB but not inspection
Pulmonary Hypertension

- Retrospective review Cleveland Clinic
- 90 pts (45 w/ pulm htn; 45 controls)
- Mean PAP 58mm Hg
- Total number of procedures was similar
- BAL, TBLB, and TBNA
- No hemodynamic, respiratory or bleeding complications
- Concluded: Bronchoscopy Safe in mild/moderate pulmonary hypertension
Advanced COPD

- COPD associated with increased complication rate in bronchoscopy
  - 5% of COPD patients compared to 0.6% of those with normal lung function
  - Especially at risk:
    - FEV\textsubscript{1}/FVC <50%
    - FEV\textsubscript{1} <1L and FEV\textsubscript{1}/FVC <69%

- Consider pre-procedure spirometry in severe COPD…increased concern if FEV\textsubscript{1} <40%

- Use sedation and O\textsubscript{2} carefully in patients with elevated CO\textsubscript{2}…concern for retention
In fact, the evidence is

- N= 57 (11 mild, 28 moderate, 18 severe)
- Mean FEV1% = 44% pred (25-75)
- 98 bronchoscopies (68/98 EBBx and BAL)
- 1 bronchospasm; 1 PTX; 3 minor hemoptysis
- No mortality
- 2% adverse events; 3% minor hemoptysis (no intervention)
- Bronchoscopy, biopsy, and BAL can be performed safely in COPD patients, including severe disease
Other results show

A Randomized, Placebo-Controlled Trial of Bronchodilators for Bronchoscopy in COPD Patients

- N=120 patients undergoing bronchoscopy were included.
- Patients with COPD were randomized to receive either 200 g of salbutamol (n 40) or placebo (n 40) or nothing (n 40) before bronchoscopy.
- Spirometry was performed before and 2 h after bronchoscopy in all patients.
The results show

- The decrease in FEV1 was similar in all three patient groups (p \(0.432\)).
- The relative change in FEV1 inversely correlated to increasing severity of COPD as expressed by GOLD stages (p \( = 0.01\)).
- **Conclusions:** Premedication with an inhaled short-acting agonist cannot be recommended in patients with COPD undergoing bronchoscopy.
Asthma

- Bronchoscopy-induced bronchospasm is seen in 0.02% of cases in one study

- Another study showed 8% of 216 asthmatic patients developed laryngospasm or bronchospasm!
Asthma

- Mild and stable asthmatics BAL could safely be performed  Chest 1991; 101:1563-1568.

- BAL and endobronchial bx could be performed safely in asthmatics
  - patient preprocedure symptoms and Pk flow variations were not predictors of procedural bronchospasm
In fact, patients with asthma

- Were noted to have more pronounced post-procedure drop in FEV$_1$ compared with normal subjects

- Falls in FEV$_1$ and FVC were greater especially after BAL and biopsies

- Pre-procedure use of bronchodilator was associated with no fall in post-procedure FEV$_1$
  - Rankin J. Bronchoalveolar lavage. Its safety in subjects with mild asthma. *Chest* 1984;85:723-8
In other studies

- Study of 50 patients (10 with severe asthma) found bronchoscopy was well tolerated
  - Even without premedication with bronchodilator

- Present consensus:
  - Asthma is not contraindication to bronchoscopy
  - Optimize asthma control prior to bronchoscopy
  - Premedicate with nebulized bronchodilator
Pregnancy: physiologic changes

- Increased respiratory drive (effect of progesterone on respiratory drive center)
- Tidal volume increases 30-35%
- Minute ventilation may increase by almost 50%

...Primary respiratory alkalosis
Pregnancy: physiologic changes

- Diaphragmatic elevation causes decrease in RV and ERV... 18% decrease in FRC
- Loss of oxygen reserve leads to rapid desaturation during hypopnea
- Oxygen consumption increases by 20% to provide for fetus and placenta
Pregnancy: physiologic changes

- Progesterone induces upper airway glandular hypertrophy… mucosal edema and bleeding
- Decreased lower esophageal sphincter tone… may increase risk of aspiration
- Uterine enlargement compresses IVC… reduces cardiac preload
Pregnant Patient

- Defer if possible until at least after 28th wk
- Explain pt and fetal risks
- Oral insertion route
- Ready access to anesthesia/fetal monitoring
- Pharmacologic consultation: lowest med doses
- Obstetrics consultation: fetal monitoring
- Position the patient in left lateral decubitus position
- Avoid fluoroscopy

Medication Risks in pregnancy

<table>
<thead>
<tr>
<th>FDA Pregnancy Risk Category</th>
<th>Fetal Risk From Drugs Administered During Pregnancy</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Controlled studies in women show no risk to the fetus in the first trimester (and there is no evidence of risk in later trimesters), and the possibility of fetal harm appears remote.</td>
</tr>
<tr>
<td>B</td>
<td>Animal reproduction studies have reported no fetal risk, and there are no controlled studies in pregnant women, or animal-reproduction studies have shown an adverse effect (other than a decrease in fertility) that was not confirmed in controlled studies in women in the first trimester (and there is no evidence of a risk in later trimesters).</td>
</tr>
<tr>
<td>C</td>
<td>Studies in animals have revealed adverse effects on the fetus (teratogenic or embryocidal, or other) and there are no controlled studies in women, or studies in women and animals are not available. Drug should be administered only if the potential benefit justifies the potential risk to the fetus.</td>
</tr>
<tr>
<td>D</td>
<td>There is positive evidence of human fetal risk, but the benefits from use in pregnant women may be acceptable despite the risk (eg, if the drug is needed in a life-threatening situation or for a serious disease for which safer drugs cannot be used or are ineffective).</td>
</tr>
<tr>
<td>X</td>
<td>Studies in animals or humans have reported fetal abnormalities or there is evidence of fetal risk based on human experience, or both, and the risk of the use of the drug in pregnant women clearly outweighs any possible benefit. The drug is contraindicated in women who are or may become pregnant.</td>
</tr>
</tbody>
</table>
The Pregnant Patient

- **Medication–Related**
  - Category B: ipratropium, meperidine, propofol
  - Category C: lidocaine, epinephrine, fentanyl
  - Category D: midazolam, diazepam
  - Use lowest effective sedation doses

- **Procedure–Related**
  - Patient positioning – left lateral decubitus
Medication Risks

- Lidocaine- Class C
- Albuterol- Class C
- Midazolam- Class D
- Fentanyl- Class C

- Lactation
  - Lidocaine and fentanyl safe
  - Albuterol probably safe
  - Midazolam unknown
Radiation Risks

- Danger depends on radiation dose and gestational age (pre-implanted embryo is most at risk)
- Associated with intrauterine death, malformations, developmental delays, carcinogenic effects
- Requires complete abdominal shielding, minimal exposure time
- Delay until after 14th gestational week
Obesity

- BMI > 30, > 40, > 50
- Pre-procedure assessment of hypercapnea
- Other effects to respiratory reserve
- Anticipating the difficulty airway and anesthesia support
- Role of CPAP during bronchoscopy
- Pre-emptive intubation

Mechanical Ventilation and ARDS

- BAL: PaO2 values dropped and remained 20% lower than baseline in 40% of patients. This persisted for 2 hours.
- Tube obstruction, VQ mismatch from BAL, derecruitment, hypoventilation
- No identifiers to predict those more likely to have significant hypoxemia
- No significant hemodynamic events (Chest 1993;104;1541-47; Am Rev Respir Dis 1993; 148:556-61)

- TBLB: 14% ptx rate, 6% hemorrhage, 8% transient hypoxemia, 7% transient hypotension, 3% transient tachycardia
- No deaths (Crit Care Med 1997;25;440-446)
Bronchoscopy Safety: Key Points

- Aspirin – OK; Plavix – NO TBLB. EBUS??
- AMI: no during active ischemia
- Arrhythmia: rare, self limited
- Elevated ICP: low risk
- PH: relative contraindication
- COPD: safe, no role for bronchodilators
- Asthma: safe, pre-procedure bronchodilators
- Pregnancy: reserved for indications that cannot wait until the postpartum period
- Mechanical ventilation/ARDS: BAL OK, TBLB assess risk:benefit
Questions?

Thank you